



# Miami-Dade Water & Sewer Department Water Supply Planning



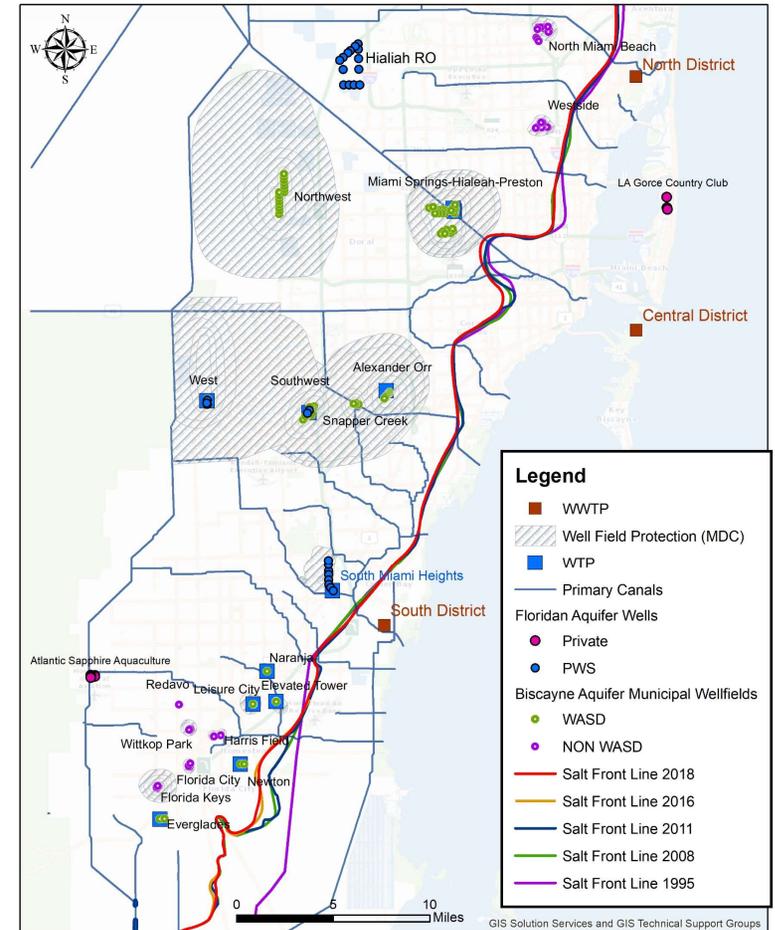
Virginia Walsh, Ph.D., P.G.  
Chief Hydrogeology Section  
Miami-Dade Water and Sewer Department

**Biscayne Bay Regional Restoration Coordination Team**  
**Tuesday June 16, 2020**

# MIAMI-DADE UTILITY OVERVIEW

## Water System

- 3 large regional and 5 small water treatment plants, and Hialeah Reverse Osmosis WTP
- Supplying an average of 320 million gallons per day (MGD)
- 8,500 miles of pipe
- 450,000 retail customers
- 15 Wholesale Customers

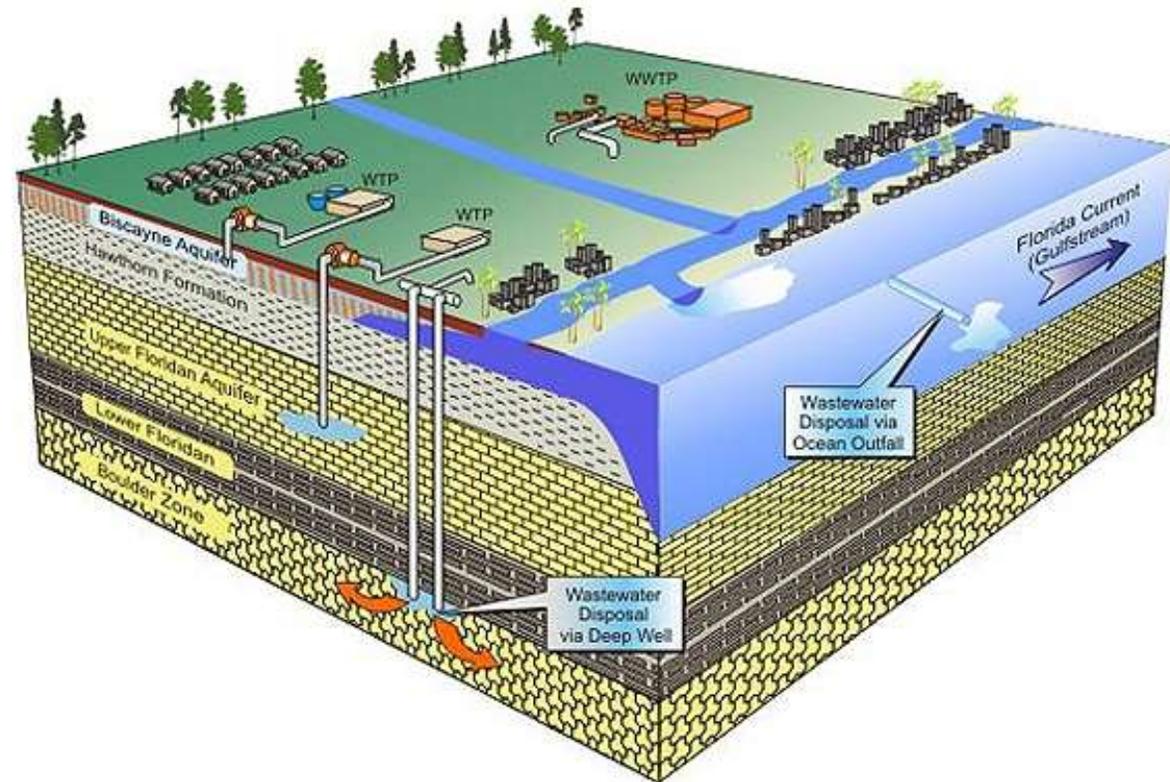


# Hydrogeology of South Florida

**80 ft BLS**  
Confining layers

**1,000 ft BLS**  
Confining layers

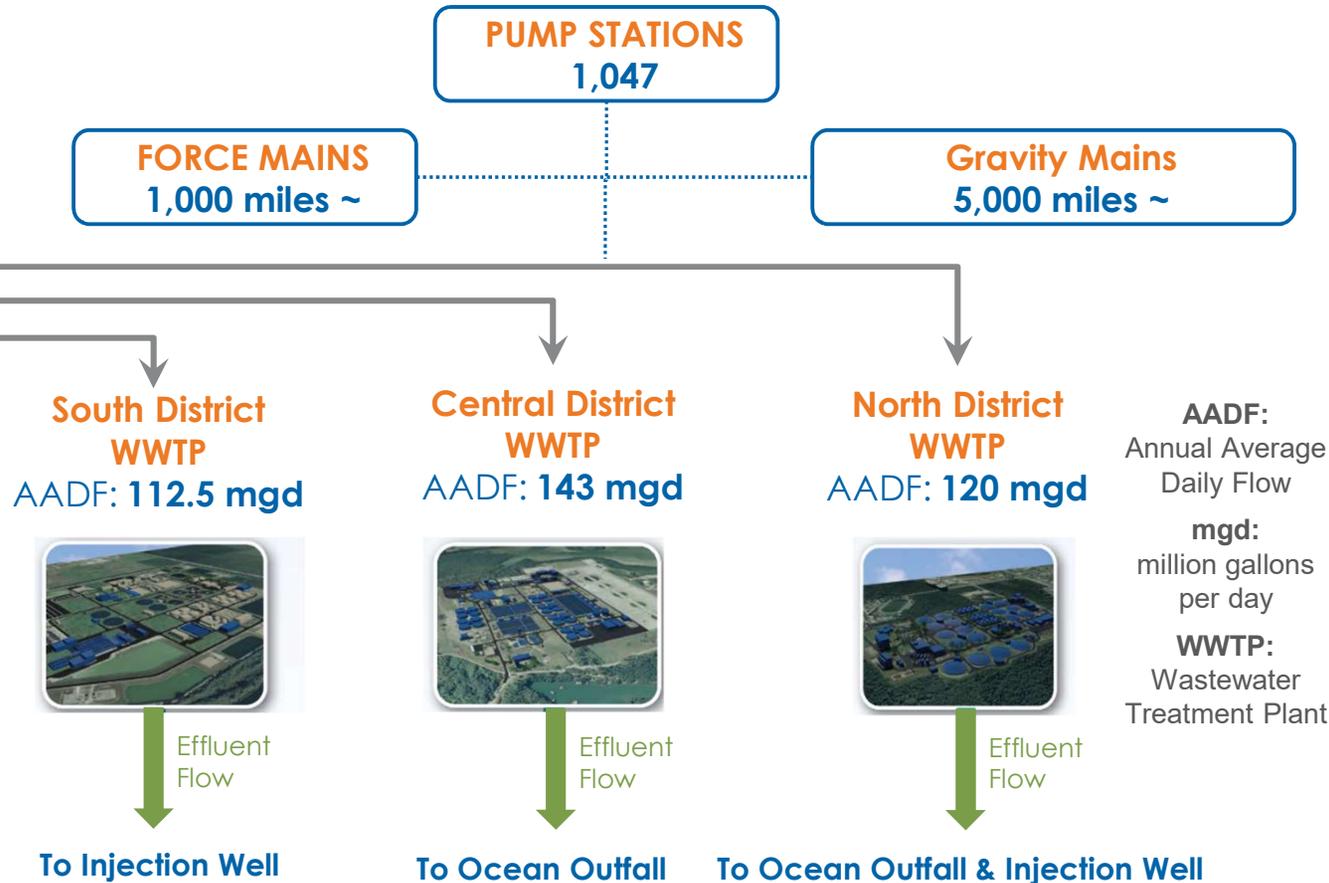
**3,000 ft BLS**



In Miami-Dade, regional wastewater disposal methods were designed to protect the Biscayne Aquifer, the major source of drinking water in Miami-Dade County, via deep injection wells and ocean outfalls.

# WASTEWATER SYSTEM OVERVIEW

## Conveyance System



# CAPITAL IMPROVEMENT PLAN

CIP

New CIP: FY 19-20

	Spent to Date (Prior: FY 2020)	Future Budget	Total Project Cost	% Spent
Consent Decree	\$530 M	\$1,287 M	\$1,817 M	29%
Pump Stations & Flow Reduction	85	304	389	22%
WASD Capital Projects	443	2,698	3,141	14%
Ocean Outfall	125	2,052	2,177	6%
<b>Totals</b>	<b>\$1,183 M</b>	<b>\$6,341 M</b>	<b>\$7,524 M</b>	<b>16%</b>

WASTEWATER \$6.0B

WATER \$1.5B



# MDWASD CONSENT DECREE PROGRAM

## CONSENT DECREE PROGRAM

**81** PROJECT  
ELEMENTS

**\$1.9** billion

DATE OF LODGING

**June 6, 2013**

EFFECTIVE DATE

**December 6, 2013**

PROGRAM DURATION

**15 years**

CAPITAL PROJECTS

**81**

SUPPLEMENTAL ENVIRONMENTAL PROJECT

**1**

PROGRAM COST

**\$1.9B**

OTHER REQUIREMENTS

**Reporting; Capacity, Management,  
Operation, and Maintenance Programs;  
Hydraulic Modeling**

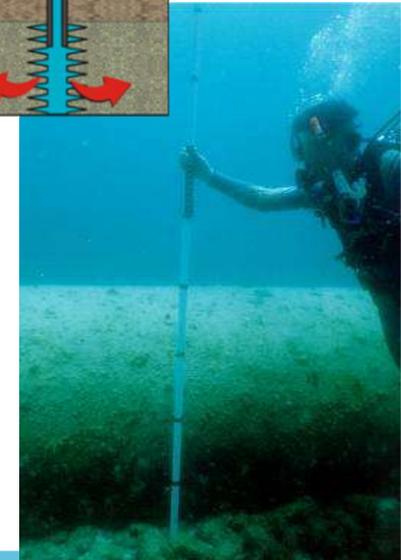
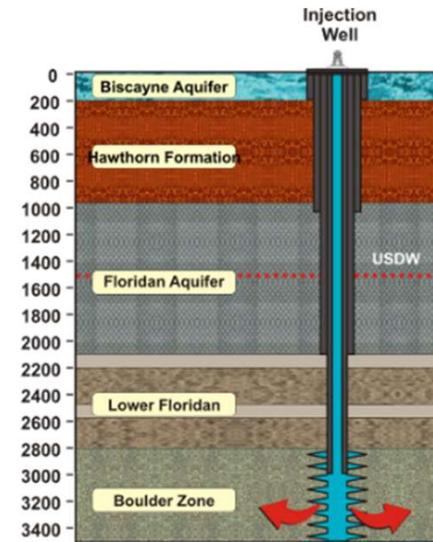


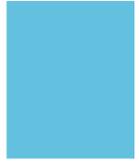
# Ocean Outfall Legislation

Florida Statutes Title CS/SB 444  
Section 403.086 Requirements:

- Wastewater utilities in southeast Florida must move away from using ocean outfalls to dispose of treated wastewater
- Reduce the use of outfalls by 2025

- 1) Nutrient Reduction**  
Reduce nutrient discharges by 2018
- 2) 60 Percent Reuse**  
Reuse 60% of the wastewater flows by 2025
- 3) Outfall Discharge**  
Peak flow disposal





# WATER SUPPLY

# MIAMI-DADE'S WATER BALANCE

## Water In:

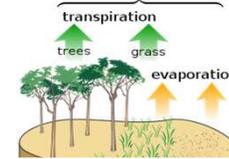


- Canals
- Rainfall
- Groundwater Seepage



## Water out:

evapotranspiration =  
transpiration + evaporation



- ET
- Water Supply
  - drinking water
  - agriculture/irrigation
  - recreational
- Canals

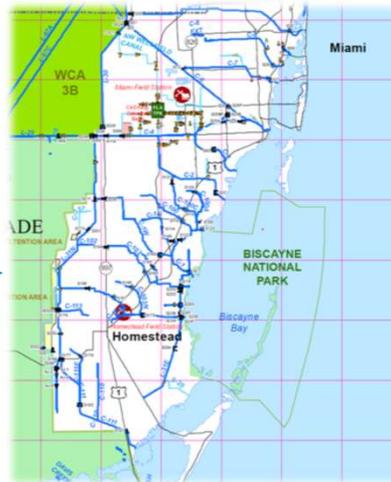


# MIAMI-DADE'S WATER BALANCE

## Water Into System

- 💧 Overland Flow <1%
- 💧 Irrigation 2%
- 💧 Regional Canals 7%
- 💧 Groundwater 30%
- 💧 Rainfall 60%

3,073 MGD



3,073 MGD

## Water Out of System

- 💧 Overland Flow 4%
- 💧 Groundwater 5%
- 💧 Pumpage – Ag 7%
- 💧 Pumpage – Public WS 11%
- 💧 Environmental Supply 13%
- 💧 Evapotranspiration 30%
- 💧 Canal to Tide 30%

In  
4079  
mgd

Wet  
Season

Out  
4130  
mgd

# Miami-Dade Water and Sewer Department 20 Year Water Use Permit Water Use allocation Brief history

- Consolidated 20 Year water use permit (WUP 13-00017-W ) first issued in November 2007  
Biscayne Base Condition limit of **347 MGD** - .  
*Groundwater and canal recharge projects required to offset proposed increased Biscayne aquifer withdrawals beyond base*
- July 16, 2012: permit modified to add FAS facilities and allocation, modify the calculated base condition from 347 MGD to **349.5 MGD** based on modeling regional system impact evaluations



SOUTH FLORIDA WATER MANAGEMENT DISTRICT  
WATER USE INDIVIDUAL PERMIT

APPLICATION NO: 140627-12      PERMIT NUMBER: 13-00017-W  
DATE ISSUED: February 9, 2015      EXPIRATION DATE: February 9, 2035

PERMITTEE: MIAMI-DADE WATER AND SEWER  
DEPARTMENT  
P O BOX 330316  
MIAMI, FL 33233-0316

PROJECT NAME: MIAMI-DADE CONSOLIDATED PWS  
PROJECT LOCATION: Miami-Dade County,      SEE ATTACHED FOR SECTIONS, TOWNSHIPS  
AND RANGES

**PROJECT DESCRIPTION/AUTHORIZING:**

The continued use of groundwater from the Upper Floridan aquifer and Biscayne aquifer for Public water supply for the MDWASD Service Area serving 2,642,929 persons in the year 2033 with an average finished water per capita use rate of 137.2 gallons per day per person and a maximum monthly to average monthly pumping ration of 1.05:1 with an annual allocation of 140,915.50 million gallons.

This is to notify you of South Florida Water Management District's (District) agency action concerning Permit Application Number 140627-12, received June 27, 2014. This action is taken pursuant to Chapter 373, Part II, Florida Statutes (F.S.), Rule 40E-1.603 and Chapter 40E-2, Florida Administrative Code (F.A.C). Based on the information provided, District rules have been adhered to and a Water Use Individual Permit is in effect for this project subject to:

1. Not receiving a filed request for an administrative hearing pursuant to Section 120.57 and Section 120.569 (F.S.), or request a judicial review pursuant Section 120.68, F.S.; and
2. The attached 57 permit conditions.
3. The attached 37 exhibits.

By acceptance and utilization of the water authorized under this permit, the Permittee agrees to hold and save the District and its successors harmless from any and all damages, claims or liabilities that may arise by reason of the construction, maintenance or use of activities authorized by this permit. Should you object to the permit, please refer to the attached "Notice of Rights" that addresses the procedures to be followed if you desire a public hearing or other review of the proposed agency action. Should you wish to object to the proposed agency action or file a petition or request, please provide written objections, petitions, requests and/or waivers to the District, attention of Office of the District Clerk, South Florida Water Management District, Post Office Box 24680, West Palm Beach, FL 33416-4680.

**CERTIFICATION OF SERVICE**

I HEREBY CERTIFY THAT this written notice has been mailed or electronically transmitted to the Permittee (and the persons listed in the attached distribution list) this 10th day of February, 2015, in accordance with Section 120.60(3), F.S. Notice was also electronically posted on this date through a link on the home page of the District's website ([my.sfwmdd.gov/ePermitting](http://my.sfwmdd.gov/ePermitting)).

BY:   
JUANITA BOZEMAN  
DEPUTY CLERK, SOUTH FLORIDA WATER MANAGEMENT DISTRICT

Application Number:140627-12

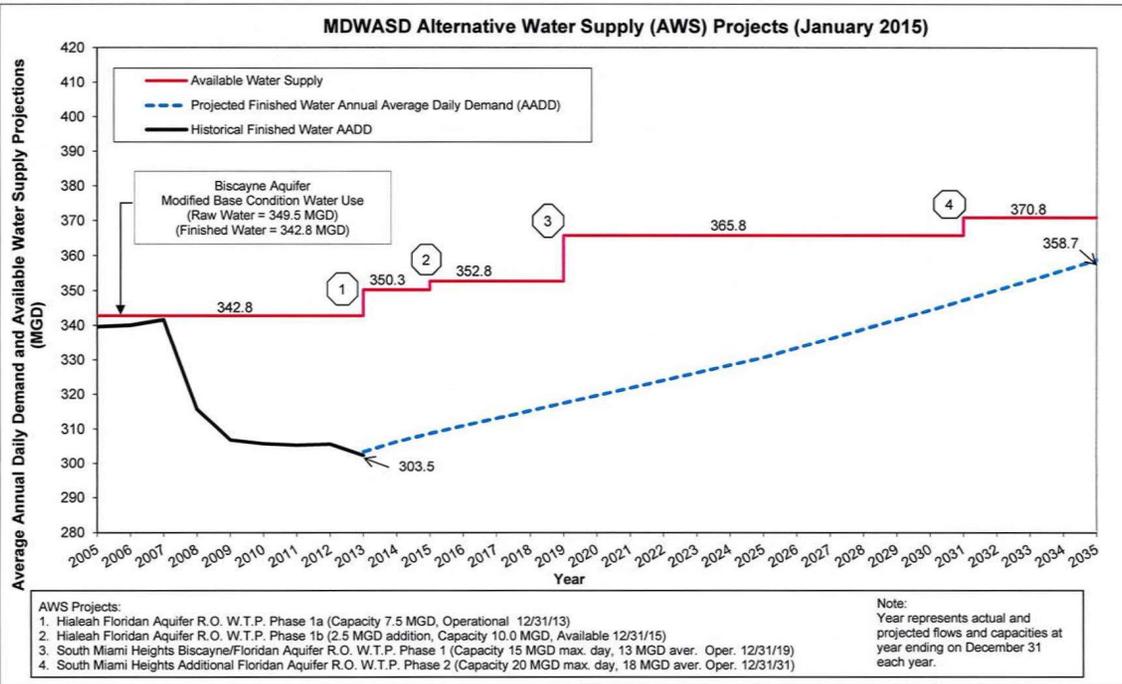
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***Modeling done with available modeling tools at the time***

## Miami-Dade Water and Sewer Department Existing 20 Year Water Use Permit Water Use allocation – Biscayne Aquifer

		Design Capacity		Water Use Permit Allocation	
		Wellfield	WTP	2007	2012
Hialeah Preston	Northwest	149.4		96.8	96.8
	Miami Springs Lower	35.7			
	Miami Springs Upper	43.6			
	Preston	53.3			
	Hialeah	12.5		70	70
		<b>294.5</b>	<b>225</b>	<b>155.4</b>	<b>155.4</b>
Alex Orr	Southwest	161.2		83.8	109.4
	Alexander Orr	74.4		62	40
	West	32.4		15	15
	Snapper Creek	40		22.1	21.9
			<b>308</b>	<b>214.7</b>	<b>182.9</b>
South Dade	Elevated Tank	4.3		1.3	1.3
	Leisure City	4.2		2.9	1.6
	Naranja	1.4		0.1	0.1
	Everglades Labor Camp	5		0.7	2.2
	Newton	4.32		2.1	2.6
		<b>19.2</b>	<b>19.2</b>	<b>7.1</b>	<b>7.8</b>

# CURRENT WATER SUPPLY PLAN AND INVESTMENTS



**Based on District Rules for Consumptive Use Permits, Future demands under existing permit met by **alternative water supply projects** including Hialeah RO Plant and South Miami Heights RO Plant at a cost of excess \$300 million**

Alternative Water Supply Projects Step Chart January 2015

**Based on District Rules for Consumptive Use Permits *Future demands under existing permit met by alternative water supply projects***



**Hialeah RO Plant – Floridan Water**

Treatment Type	Capital (\$/gallon-day)	O&M (\$/1,000 gallons)
Floridan RO	\$6.00-\$8.00	\$1.75-\$2.50



**South Miami Heights RO Plant – primarily Floridan Water**



**Advanced Wastewater Treatment - reuse**

Indirect Potable Reuse	\$12.00-15.00	\$2.50-\$3.00
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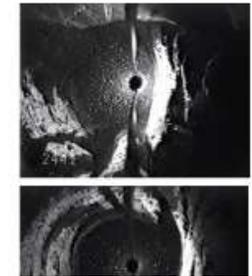
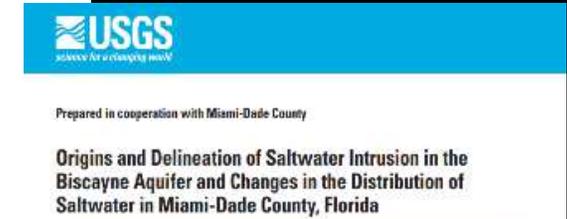
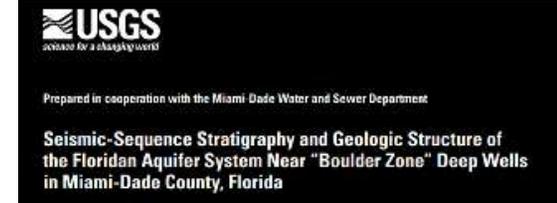
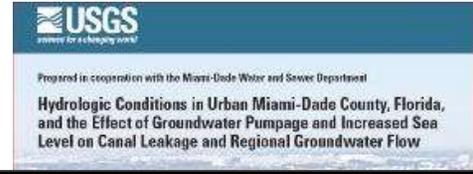
*None of which take advantage of excess flows during the wet season of high quality Biscayne Aquifer water that is lost to tide*

# HYDROGEOLOGICAL RESEARCH

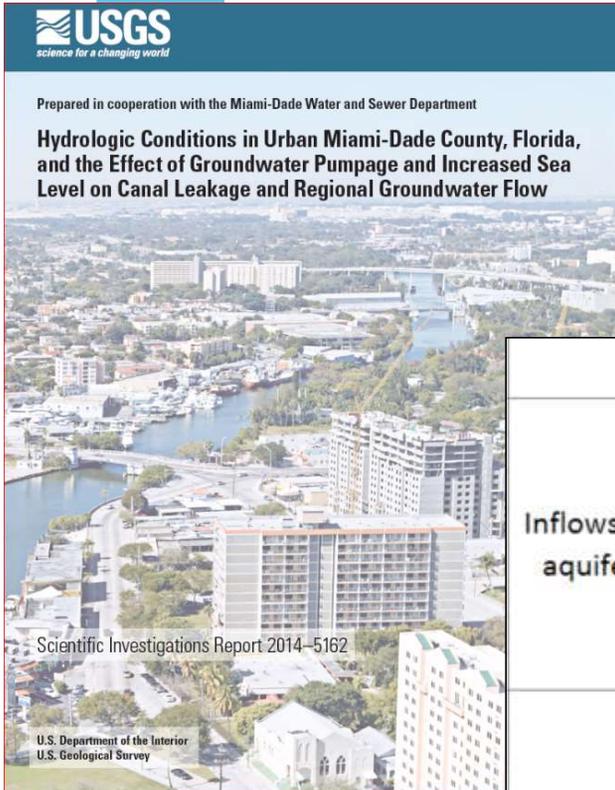
Miami-Dade has committed to developing the Science and Data Driven Tools to better manage Water resources

## Miami-Dade County Joint Funding Agreements with the US Geological Survey

Project	USGS	WASD	DERM	Total County	Total Project
Regional Impact Assessment project		\$ 2,702,870.00		\$ 2,702,870.00	\$ 2,702,870.00
Salt Front Update project		\$ 1,825,764.00		\$ 1,825,764.00	\$ 1,825,764.00
Biscayne Aquifer Groundwater Model	\$ 440,262.00	\$ 1,384,756.00	\$ 1,384,756.00	\$ 2,769,512.00	\$ 3,209,774.00
Biscayne Aquifer Model Software	\$ 100,000.00	\$ 565,037.00		\$ 565,037.00	\$ 665,037.00
Investigation of microconstituents	\$ -	\$ 120,000.00	\$ 120,000.00	\$ 240,000.00	\$ 240,000.00
Investigation of microconstituents Extension	\$ 120,837.00	\$ 750,000.00		\$ 750,000.00	\$ 870,837.00
Water Resource Investigations 2008	\$ 102,144.00	\$ 285,694.00	\$ 239,550.00	\$ 525,244.00	\$ 627,388.00
Water Resource Investigations 2009	\$ 108,929.00	\$ 431,387.00	\$ 250,650.00	\$ 682,037.00	\$ 790,966.00
Water Resource Investigations 2010	\$ 108,929.00	\$ 420,293.00	\$ 260,918.00	\$ 681,211.00	\$ 790,140.00
Water Resources Investigations 2011	\$ 108,929.00	\$ 460,338.00	\$ 271,718.00	\$ 732,056.00	\$ 840,985.00
Water Resources Investigations 2013-2018	\$ 1,478,875.00	\$ 5,580,526.00	\$ 1,627,634.00	\$ 7,208,160.00	\$ 8,687,035.00
Water Resources Investigations 2018-2028	\$ 896,050.00	\$ 11,617,534.00	\$ 3,549,855.00	\$ 15,167,389.00	\$ 16,063,439.00
SWWF ASR Microbial		\$ 370,650.00		\$ 370,650.00	\$ 370,650.00
NDWWTP GWS	\$ 300,000.00	\$ 752,107.00		\$ 752,107.00	\$ 1,052,107.00
NDWWTP Tomography		\$ 437,888.00		\$ 437,888.00	\$ 437,888.00
SDWWTP GWS extension	\$ 155,000.00	\$ 580,362.00		\$ 580,362.00	\$ 735,362.00
SWWTP GWS	\$ 300,000.00	\$ 655,236.00		\$ 655,236.00	\$ 955,236.00
SDWWTP and Seismic	\$ 2,772,202.00	\$ 10,110,145.00		\$ 10,110,145.00	\$ 12,882,347.00
<b>Total</b>	<b>\$ 4,219,955.00</b>	<b>\$ 28,940,442.00</b>	<b>\$ 7,705,081.00</b>	<b>\$ 36,645,523.00</b>	<b>\$ 40,865,478.00</b>



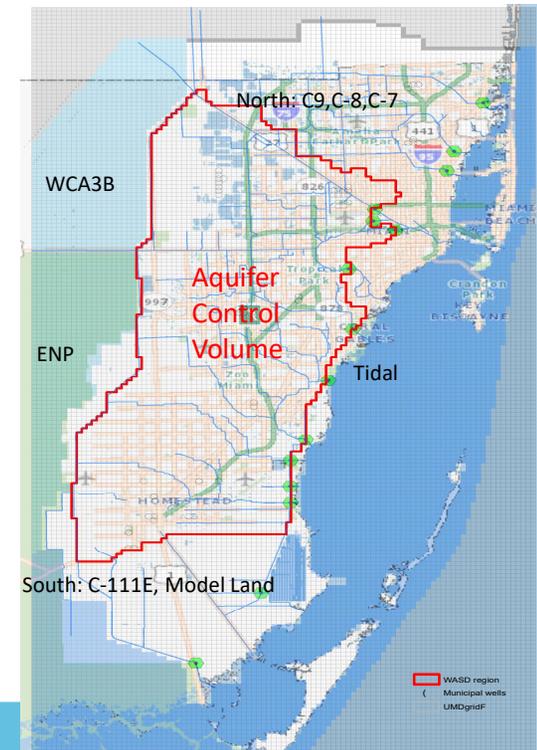
# Science and Data Driven Tools



County has developed with the USGS advanced modeling tools to evaluate aquifer-canal interactions during WASD pumpage, and the effects of SLR on salt water intrusion

	Budget Component
Inflows to aquifer	Recharge (rain, septic, irrigation)
	From Canal (leakage)
	From WCA3B and ENP
	From Tidal (lateral)
	From South (C-111E, Model Land)
	From North (C-9, C-8, C-7)
	Storage
	TOTAL
Outflow from aquifer	ET
	To canal (seepage)
	To WCA3B and ENP
	To Tidal lateral
	To South (C-111E, Model Land)
	To North (C-9, C-8, C-7)
	Agricultural Water Use
	Municipal pumpage - WASD
Municipal pumpage - NO WASD	
	Storage
	TOTAL

Impact from Regional system

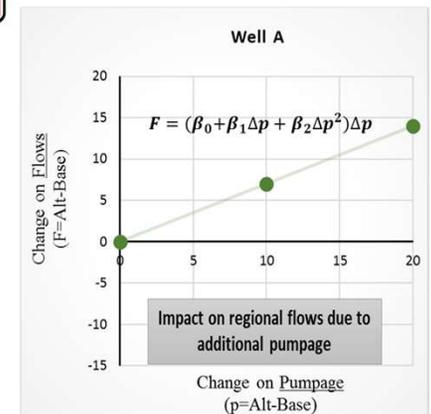


# Optimization Decision Tool (ODT)

- To determine quantity of additional Biscayne aquifer water (Well Field Distributions) for public water supply not offsetting regional flows
- Minimizing Regional Flows: Canal Leakage, Everglades Seepage, and Tidal Flux
- Integrated with the USGS Urban Miami Dade Model (UMD)

	Budget Component
Water flows into the Biscayne Aquifer (Inflows)	Recharge (rain, septic, irrigation)
	From Canal (leakage, recharge)
	From WCA3B and ENP
	From Tidal (lateral)
	From South (C-111E, Model Land)
	From North (C-9)
	Storage Change
TOTAL	
Water flows out of the Biscayne Aquifer (Outflows)	ET
	To canal (seepage, excess)
	To WCA3B and ENP
	To Tidal lateral
	To South (C-111E, Model Land)
	To North (C-9)
	Agricultural Water Use
	Municipal pumpage - WASD
	Municipal pumpage - Non WASD
	Storage Change
TOTAL	

Regional System Flows



Pumpage

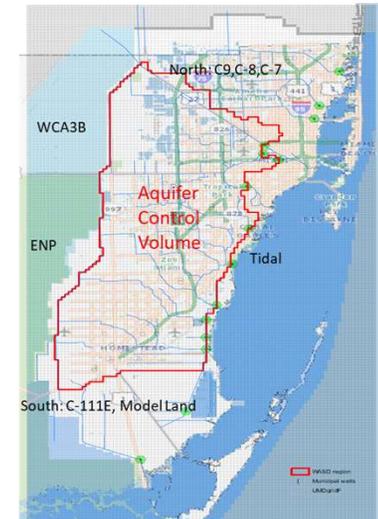
# UMD Model

## Water User Permit Modification

- Optimization of wet/dry season flows
- Response of system compared with Base Scenario (current Permitted Allocation)
- Mass-balance aquifer inflows & outflows
  - Regional Flows
  - Exchanges of Sources

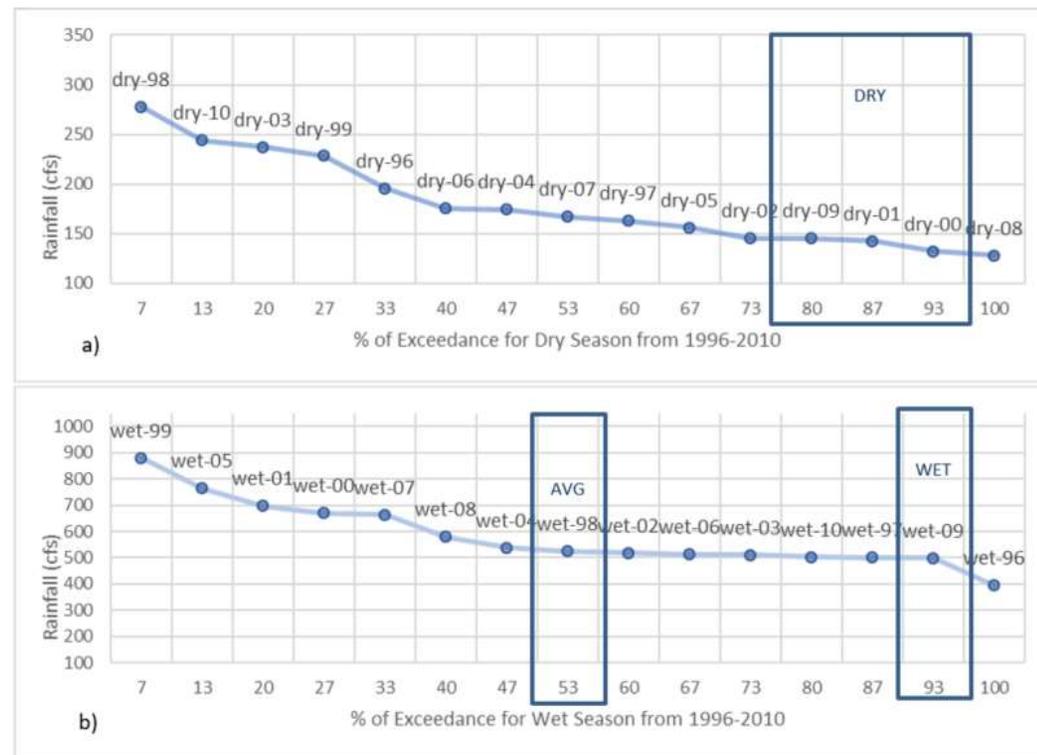
	Budget Component
Inflows to aquifer	Recharge (rain, septic, irrigation)
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	From South (C-111E, Model Land)
	From North (C-9, C-8, C-7)
	Storage
	TOTAL
Outflow from aquifer	ET
	To canal (seepage)
	To WCA3B and ENP
	To Tidal lateral
	To South (C-111E, Model Land)
	To North (C-9, C-8, C-7)
	Agricultural Water Use
	Municipal pumpage - WASD
	Municipal pumpage - NO WASD
	Storage
	TOTAL

Impact from Regional system



## UMD Model Water User Permit Modification

- Weather Conditions based on 1 in 10 dry conditions for both wet and dry seasons
  - Average Pre-Condition (six months): May 2008 - Oct 2009
  - Dry Season (seven months): Nov 2008 - May 2009
  - Wet Season (five months): Jun 2009 - Oct 2009
  - *Validated with the last 90 years of data*



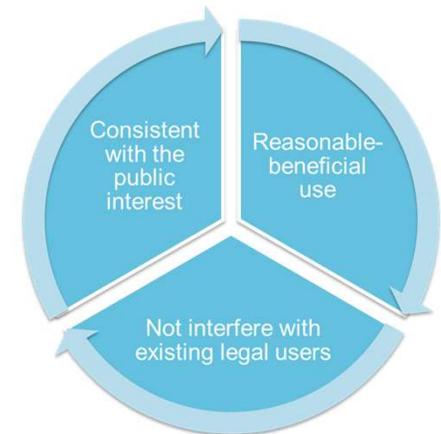
**Figure 1.** Percentage of exceedance of rainfall for C-4 Watershed for the a) dry season, and b) wet season for the simulation period

## WASD draft WUP Modification

*optimize use of wet season flows to meet future water supply projections*

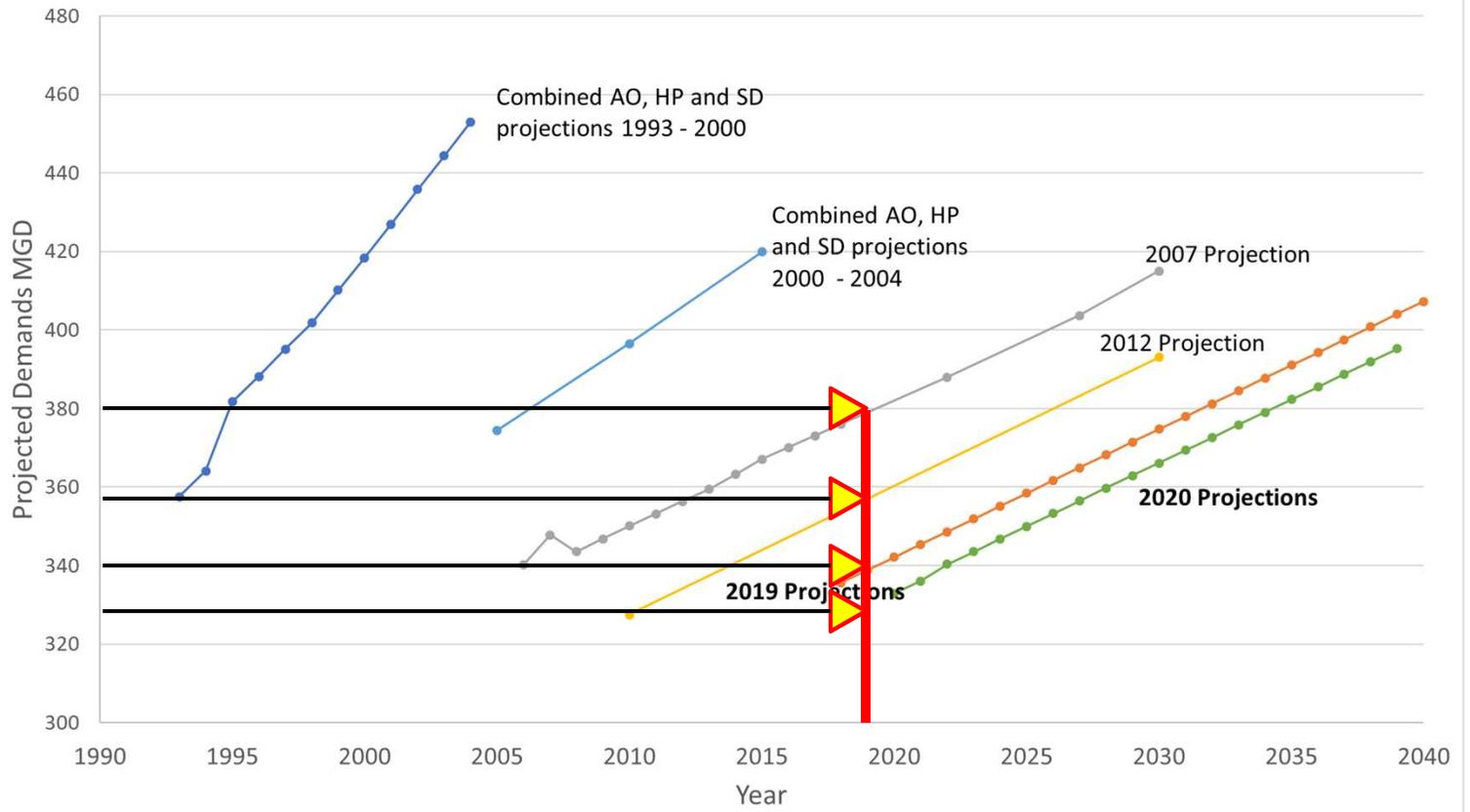
- WASD/SFWMD Permitting Staff working together since 2017
- District Staff have been fully involved in the process
- Impact Evaluations determined using peer reviewed published USGS models
- Meetings with stakeholders
- Permit Application is in compliance with the 3 basic criteria in the *Applicant's Handbook*:

### *the 3-Pronged Approach*



- **Integrating a Variety of Stakeholders and Competing Interests into a Managed Aquifer Concept**

Demand projections are difficult to predict 20 years in advance



## WUP MODIFICATION



- Optimization of Wet/Dry season flows
  - Aquifer Storage and Recovery (ASR)
  - C-51 Reservoir
- 
- Optimizing existing infrastructure and developing new wellfields under WUP modification
  - Integrate *Smart Wellfield* technology into operations



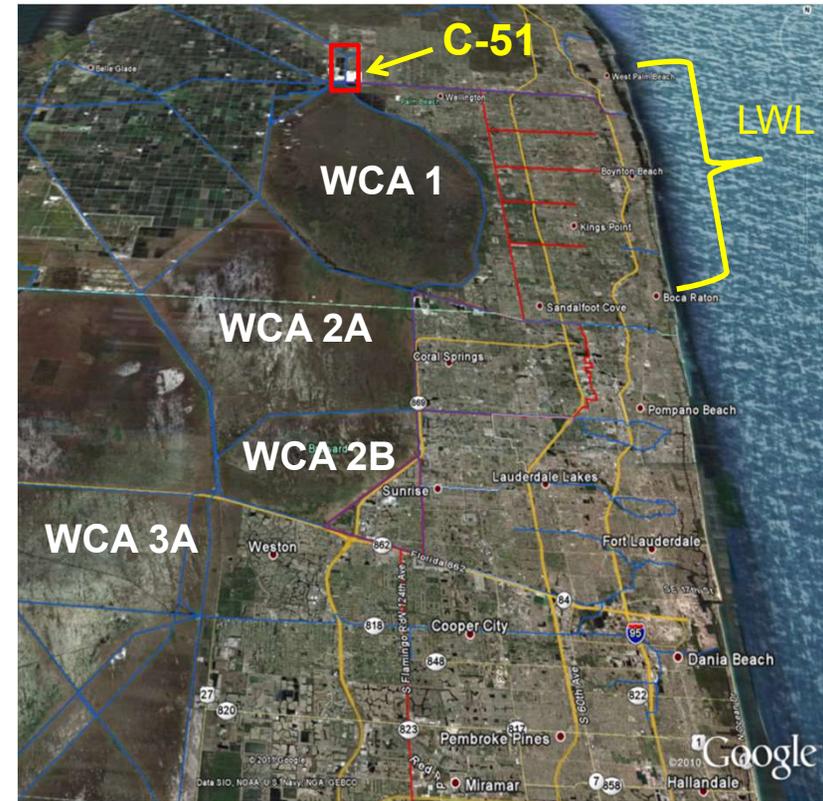
## Water control and Storage areas and Treatment Areas

### C-51 Reservoir

- 15 MGD capacity
- Integrate into optimization of Biscayne Aquifer water supply and environmental restoration
- Develop ASR systems at NWWF and other wellfields to take advantage of C-51 wet season flows

# C-51 Reservoir Project

- Capture excess fresh water currently being sent to tide through the Lake Worth Lagoon from the C-51 Canal and reducing harmful discharges
- Storage for public drinking water supply and significant environmental benefits
- Convey excess fresh water to reservoir, then use stored water to recharge public drinking water surficial aquifer well fields in Palm Beach, Broward and Miami-Dade through existing canals







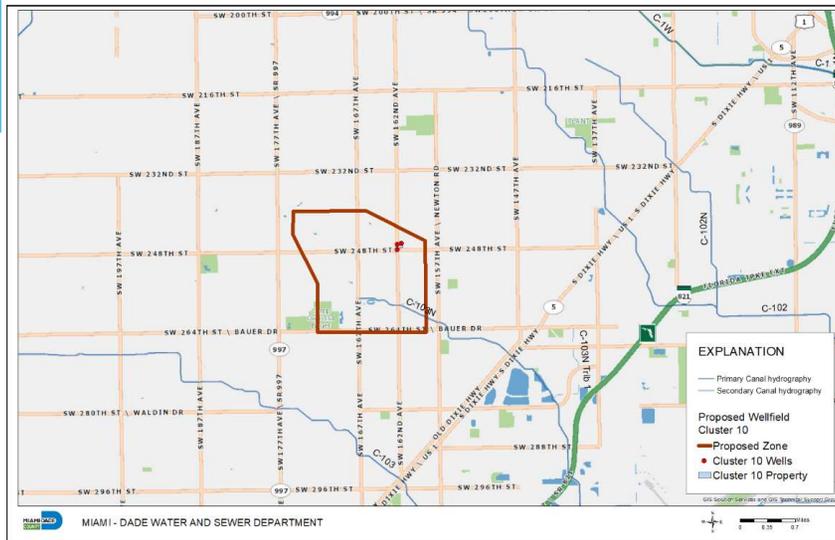
- MD County will participate in C-51 for a 15 mgd 45 year allocation
- Will be on BCC July Agenda for execution

<b>Cost Comparison</b>		
<b>15,000,000 Gallons Per Day Capacity</b>		
	<b>C-51 Phase 1 South of I-595 (Using Alexander Orr Lime Treatment Plant)</b>	<b>South Miami Heights New Floridan Aquifer Wells and Reverse Osmosis Plant</b>
Design Flow rate - GPD	15,000,000	15,000,000
Annualized Gallons (365 days)	5,475,000,000	5,475,000,000
<b>Capital Costs</b>		
New Floridan RO System Including Treatment Facilities		\$111,000,000
C-51 Reservoir Storage Capacity Allocation	\$69,000,000	
Additional Pumps South of I-595 (Possible Sharing)	\$9,000,000	
<b>Total Capital Costs</b>	<b>\$78,000,000</b>	<b>\$111,000,000</b>
<i>capital cost per gallon</i>	\$ 5.20	\$ 7.40
<b>C-51 Reservoir Capital Savings</b>	<b>\$33,000,000</b>	
<b>Annual O&amp;M Costs</b>		
Water Treatment Costs per 1000 gal	\$ 0.58	\$ 2.74
C-51 and Conveyance per 1000 gal (Estimates)	\$ 0.12	
<i>Total O&amp;M cost per 1000 gallons</i>	\$ 0.70	\$ 2.74
<b>Total Annual O&amp;M Costs</b>	<b>\$ 3,832,500</b>	<b>\$ 15,001,500</b>
<b>C-51 Reservoir O&amp;M Savings Per Year</b>	<b>\$ 11,169,000</b>	

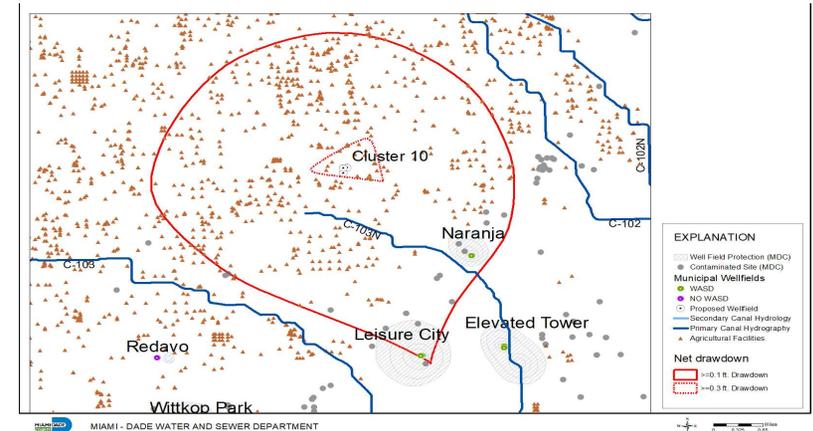


## C-51 Reservoir Status

- Phase I Capacity – 35 MGD
  - Executed Capacity Allocation Agreements – 13 MGD Total
    - Broward County – 6 MGD
    - Sunrise – 5 MGD
    - Dania Beach – 1 MGD
    - Hallandale Beach – 1 MGD
  - Capacity Allocation Agreements Consideration – 10 MGD Total
    - Margate – 2 MGD
    - Pompano – 2 MGD
    - Fort Lauderdale – 6 MGD
  - Pending Executed Capacity Allocation Agreement
    - **Miami-Dade County – 15 MGD**
- 



- Developing new wellfields to optimize County water not regional water
- ASR facilities to store excess wet season water



- Making water available in the dry season for:
- Public Water supply
  - Environmental restoration
  - Agricultural

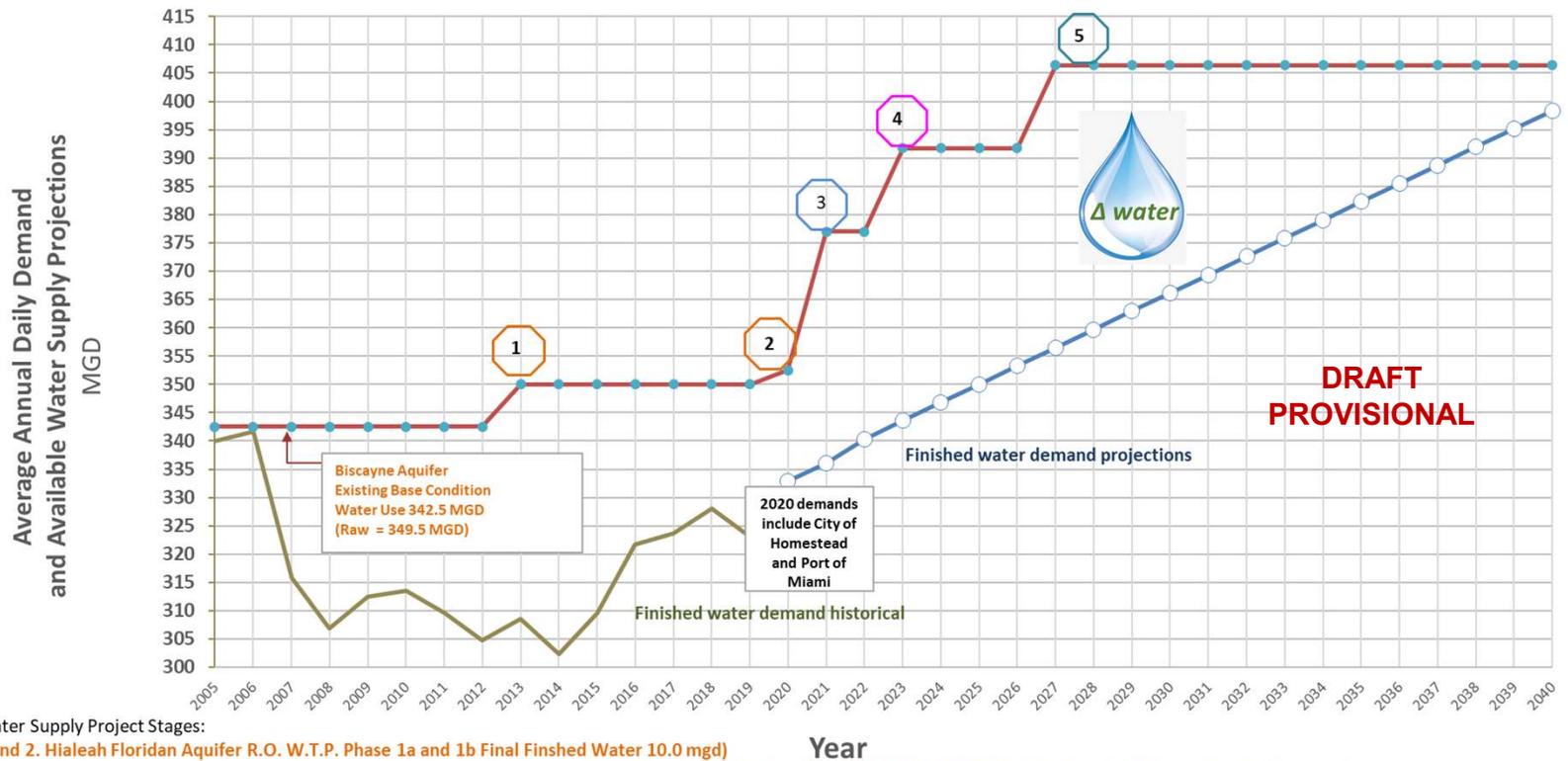
Wellfield System (MGD)	BASE (MGD)	Scenario 0		Scenario 1		Scenario 2		Scenario 3		Scenario 4	
		Optimal allocation (current system) without Cluster 10		Optimal allocation* with Cluster 10		Optimal allocation* with Cluster 10 and Optimized C-51 on top		Optimized allocation* including Cluster 10 and C-51		Optimized allocation* including C51 (without Cluster 10)	
		Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
<b>Alexander Orr (Central Service Area)</b>											
Southwest	109.4	130.23	135.93	126.85	127.68	131.85	127.68	145.48	142.16	152.99	141.04
Alexander Orr	40.0	54.00	42.37	52.00	70.00	52.00	70.00	54.00	43.38	54.00	58.45
West	15.0	4.62	0.00	0.00	0.00	15.00	15.00	15.00	14.99	15.00	14.99
Snapper Creek	21.9	0.00	0.00	0.00	8.58	0.00	8.58	0.00	0.00	0.00	0.00
<b>Subtotal</b>	<b>186.3</b>	<b>188.84</b>	<b>178.30</b>	<b>178.85</b>	<b>206.26</b>	<b>198.85</b>	<b>221.26</b>	<b>215.12</b>	<b>200.99</b>	<b>221.99</b>	<b>214.48</b>
<b>Hialeah-Preston (North Service Area)</b>											
Northwest	85.4	111.02	111.02	112.73	94.13	112.73	99.13	111.02	111.02	111.02	111.02
Miami Springs Lower	13.4	14.60	18.99	18.72	13.91	18.72	13.91	8.96	18.99	16.45	18.99
Miami Springs Upper	16.3	6.96	6.96	6.96	6.96	6.96	6.96	6.96	6.96	6.96	6.96
John E. Preston	37.2	43.35	43.35	46.50	37.87	46.50	37.87	37.20	41.12	37.20	42.17
Hialeah	3.1	1.20	1.20	1.56	6.20	1.56	6.20	6.20	6.20	6.20	6.20
<b>Subtotal</b>	<b>155.40</b>	<b>175.97</b>	<b>186.52</b>	<b>186.47</b>	<b>159.06</b>	<b>186.47</b>	<b>164.06</b>	<b>169.70</b>	<b>183.83</b>	<b>177.83</b>	<b>185.34</b>
<b>South Dade (South Service Area)</b>											
Elevated Tank	1.3	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Leisure City	1.6	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Naranja	0.1	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
Everglades Labor Camp	2.2	3.98	3.98	3.98	3.98	3.98	3.98	3.98	3.98	3.98	3.98
Newton	2.6	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
<b>Subtotal</b>	<b>7.8</b>	<b>9.68</b>	<b>9.68</b>	<b>9.68</b>	<b>9.68</b>	<b>9.68</b>	<b>9.68</b>	<b>9.68</b>	<b>9.68</b>	<b>9.68</b>	<b>9.68</b>
<b>Cluster 10</b>		<b>0.00</b>	<b>0.00</b>	<b>15.00</b>	<b>15.00</b>	<b>15.00</b>	<b>15.00</b>	<b>15.00</b>	<b>15.00</b>	<b>0.00</b>	<b>0.00</b>
<b>Total</b>	<b>349.5</b>	<b>374.50</b>	<b>374.50</b>	<b>390.00</b>	<b>390.00</b>	<b>409.50</b>	<b>409.50</b>	<b>409.50</b>	<b>409.50</b>	<b>409.50</b>	<b>409.50</b>
<b>Regional flow offset with C-51 (mgd):</b>		<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>10</b>	<b>10</b>	<b>11</b>	<b>11</b>	<b>20</b>	<b>20</b>

\* WASD's Current Wellfield system

Permit modification takes advantage of seasonal flows and operational flexibility to increase Biscayne Aquifer allocation to meet demands

● Current available and Optimized  
 2020 WUP Modification Total 406 MGD  
 390 MGD raw Biscayne Aquifer Water  
 = 382 MGD Finished Water  
 10 MGD Finished Floridan Aquifer water  
 C-51 15 MGD purchased allocation = 14.7 MGD Finished water

**Potential WASD Water Supply**  
**Chart (Draft May 18 2020)- DRAFT VERSION 4**  
**All Sources Finished Water with C-51 Reservoir (revised 15 mgd)**



Water Supply Project Stages:

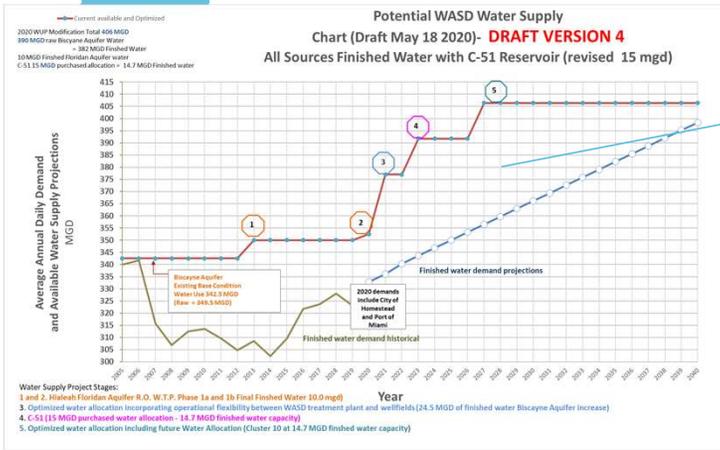
- 1 and 2. Hialeah Floridan Aquifer R.O. W.T.P. Phase 1a and 1b Final Finished Water 10.0 mgd)
3. Optimized water allocation incorporating operational flexibility between WASD treatment plant and wellfields (24.5 MGD of finished water Biscayne Aquifer increase)
4. C-51 (15 MGD purchased water allocation - 14.7 MGD finished water capacity)
5. Optimized water allocation including future Water Allocation (Cluster 10 at 14.7 MGD finished water capacity)

**DRAFT PROVISIONAL**



# Aquifer Storage and Recovery

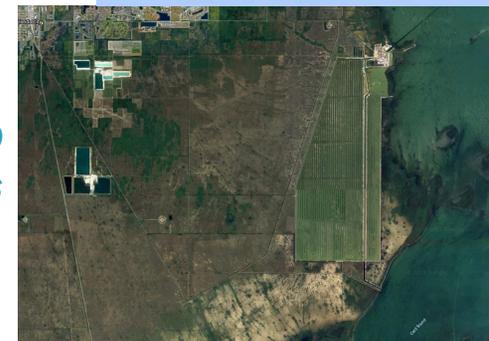
- Optimize existing 25 MGD capacity ASR systems and build new ASR infrastructure to create water supply
- Use existing and develop new ASR systems in cooperation with SFWMD and DERM for Environmental restoration water supply
- Develop flood control ASR systems in agricultural and flood prone areas

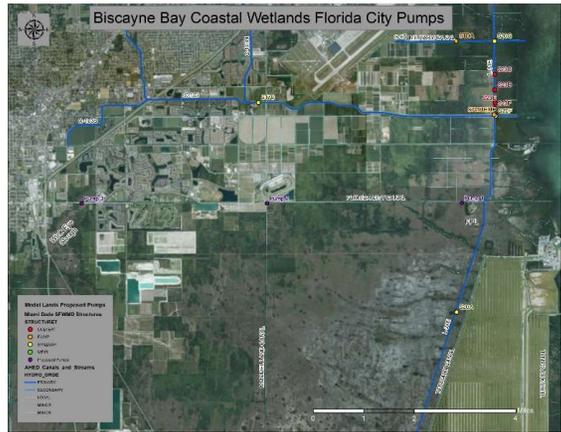
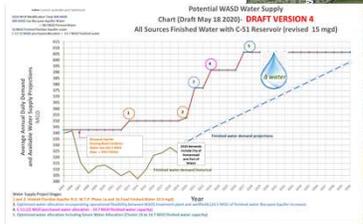


available for Environmental Restoration by integrating existing and future WASD ASR systems and water supply



Future WASD ASR systems





***Biscayne Bay Coastal Wetlands Projects County could now develop using WUP Modification delta water:***

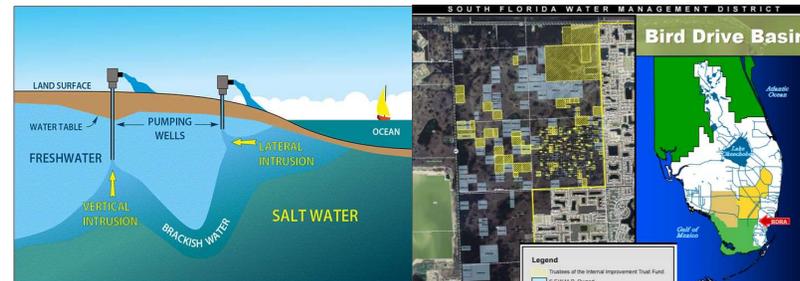
- Projects would use available Biscayne Aquifer water with no treatment costs
- Projects will provide water to Biscayne Bay Coastal Wetlands rehydration
- Projects will mitigate advancing salt front in County
- Projects could be designed, constructed and on-line in 2 year time schedule

## Integrating a Variety of Stakeholders and Competing Interests into a Managed Aquifer Concept

- WASD is orienting its Capital Planning to optimize available Water Resources.
- Engaging key stakeholders to develop and coordinate strategy (RER-DERM, South Florida Water Management District, Everglades National Park, etc.)
- Opportunities involve the implementation of aquifer storage and recovery, wastewater reuse, and other actions.

***Capital Investments for Optimizing Water Resources means cleaner water available all Stakeholders***

*Salt Water  
Intrusion  
Mitigation*



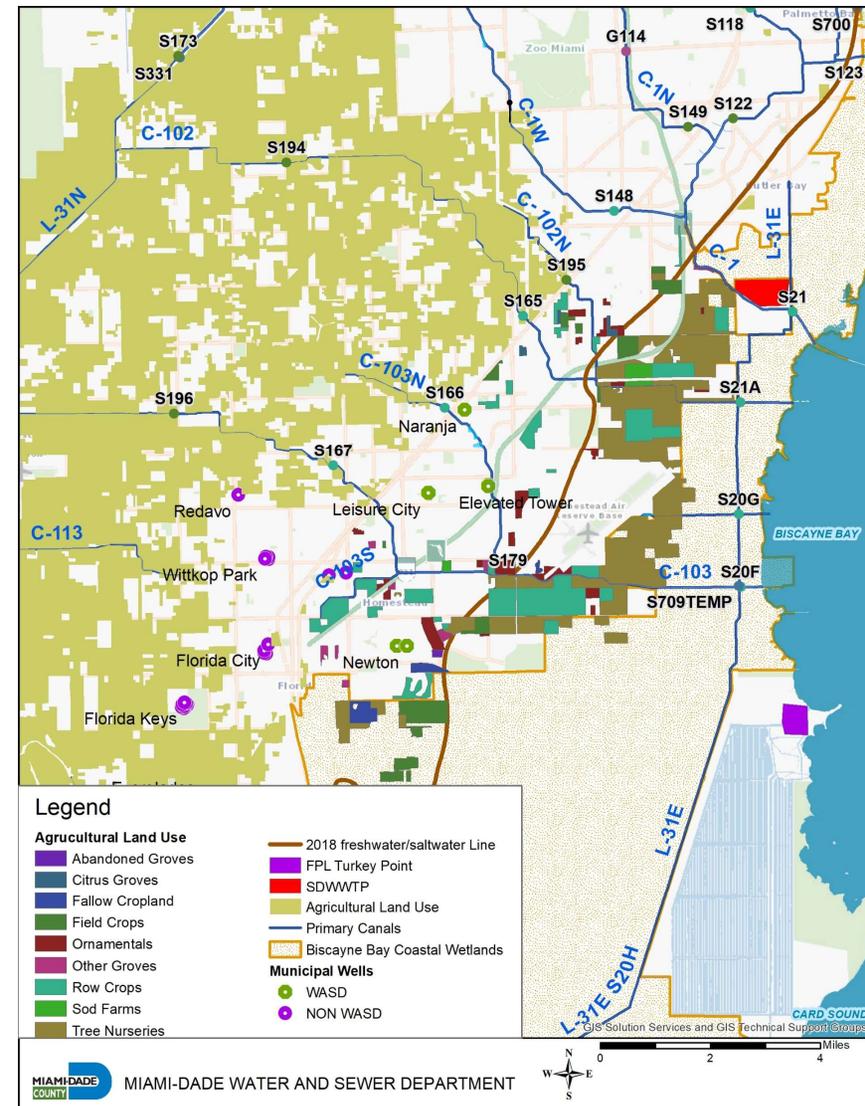
*Environmental  
Restoration*



*Potable  
Water  
and  
Agriculture*

# Groundwater Modeling to Evaluate District's Agricultural Seasonal Drawdown Operations (ASDO) at South Miami-Dade

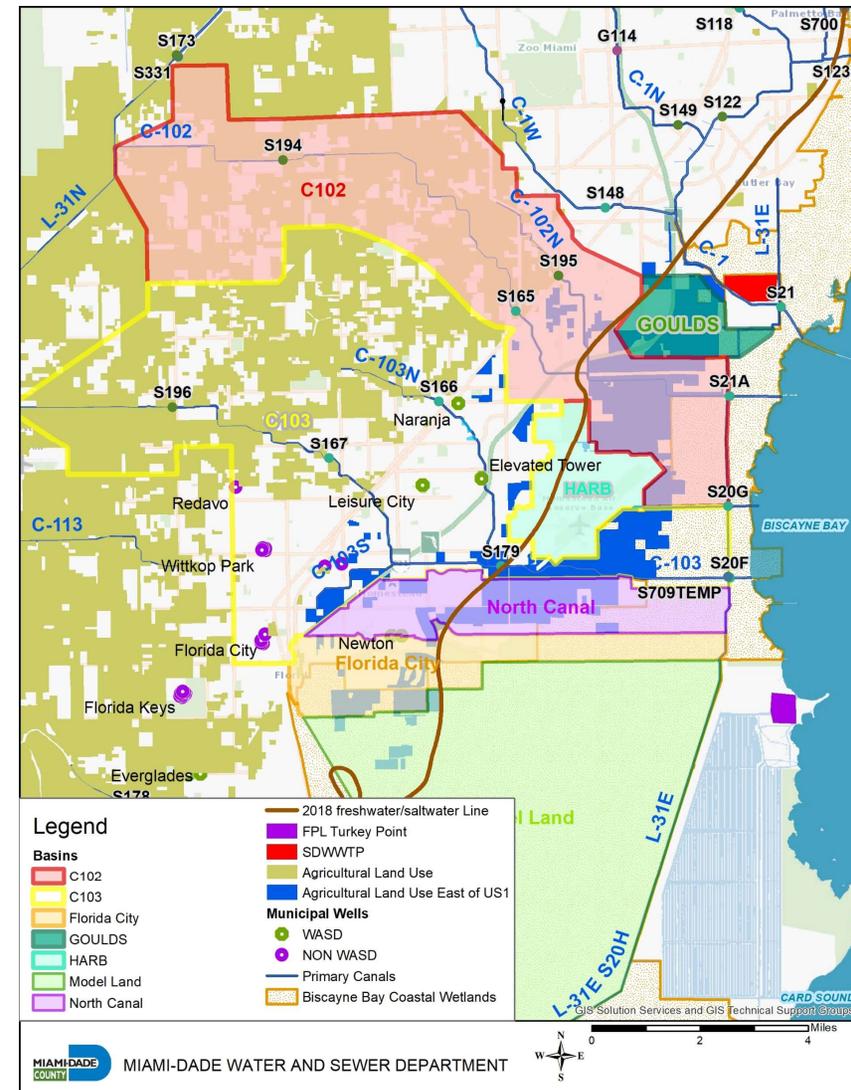
- Presented to Miami-Dade/Biscayne Bay Watershed team



## SFWMD's Agricultural Seasonal Drawdown Operations (ASDO)

Involves an increase in canals' gate opening, releasing extra volumes of fresh water during dry season, into Biscayne Bay

- Releases: ~ 21.4 BG each year (**58 MGD**) via C-103 & C-102
- Releases: ~ **80 MGD** in anticipation of winter growing season (October 15 - April 30) via S-21A & S-20F
- Benefit ~ 6,000 acres of agricultural land

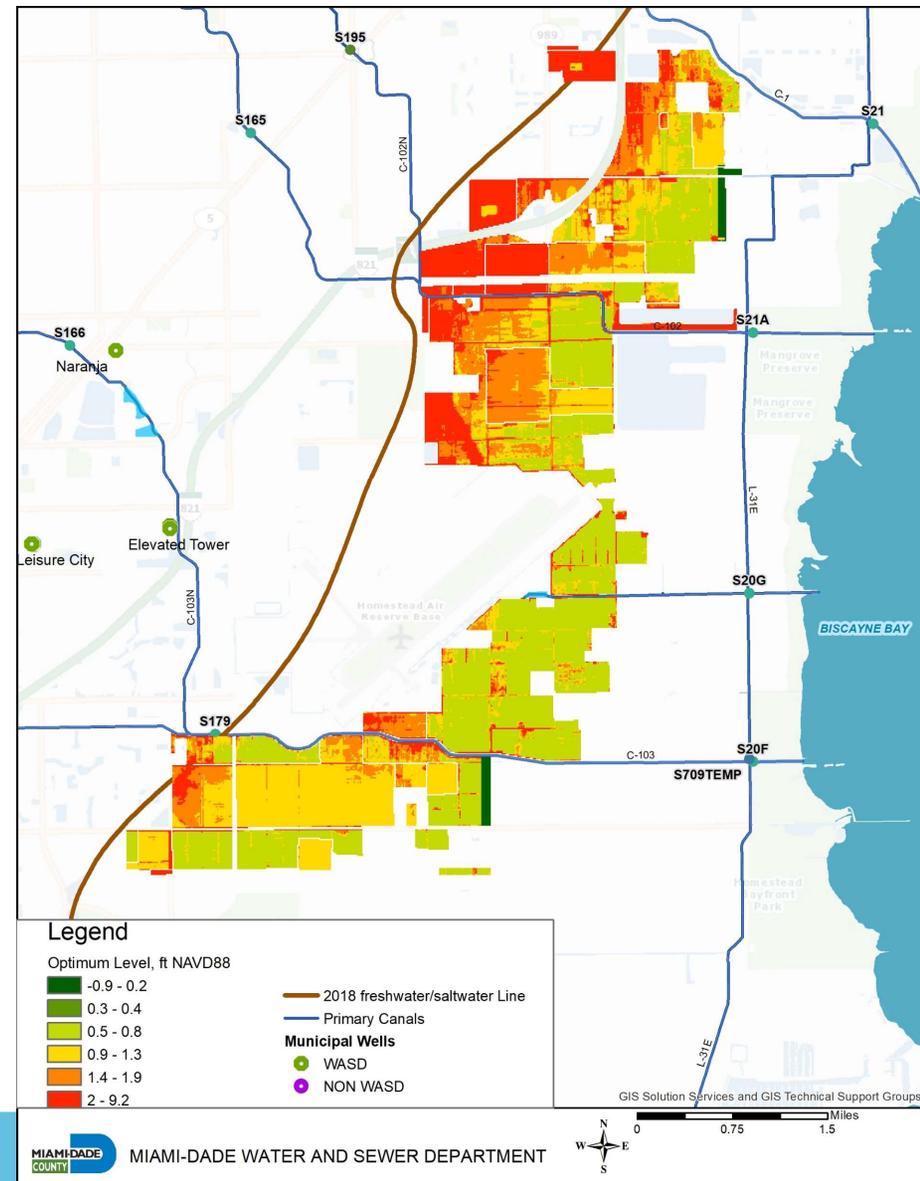


- 
- To consider an alternative to better manage the water table in the agricultural areas, as an eventual replacement to the current agricultural drawdown
    - To manage water down (ASR cycle testing): opportunities to capture excess water for env. restoration and/or PWS
  - To use water withdrawals to address Biscayne Bay Coastal Wetlands, and/or FPL needs through a series of low pumpage wells within the agricultural areas



## Optimum Groundwater Level in AGR areas (e.g., Targets)

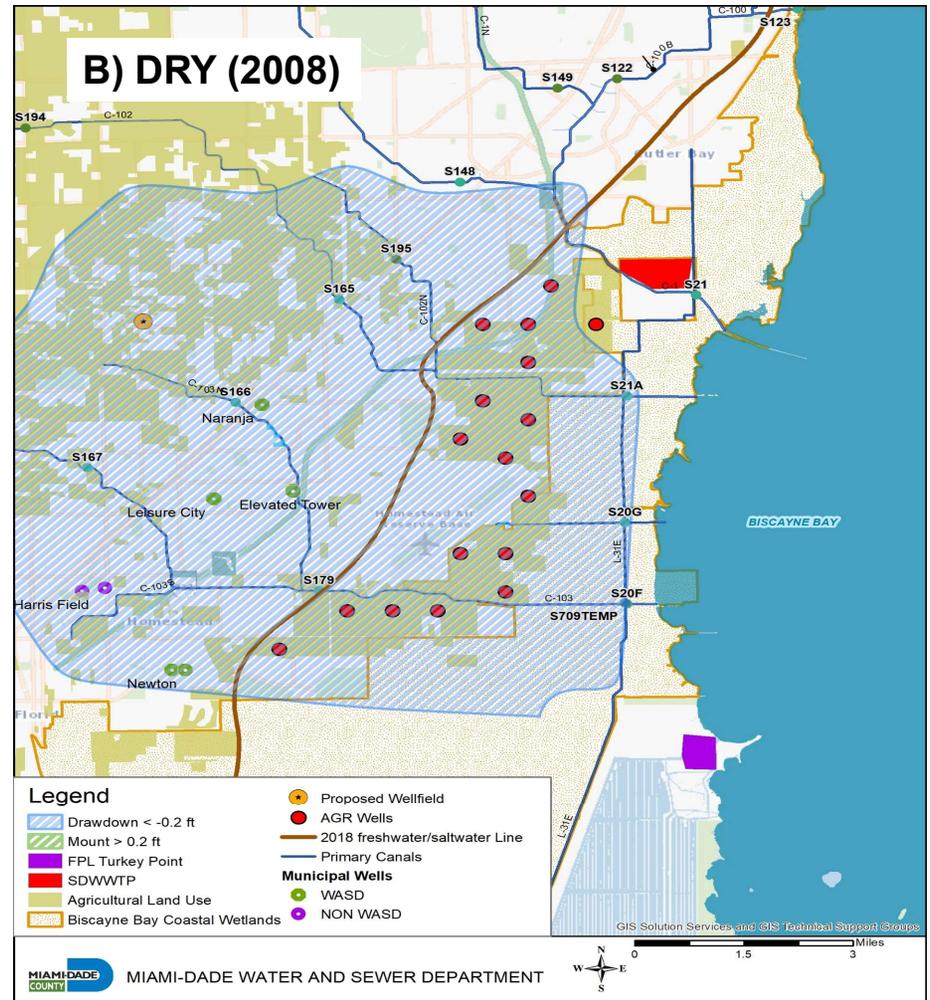
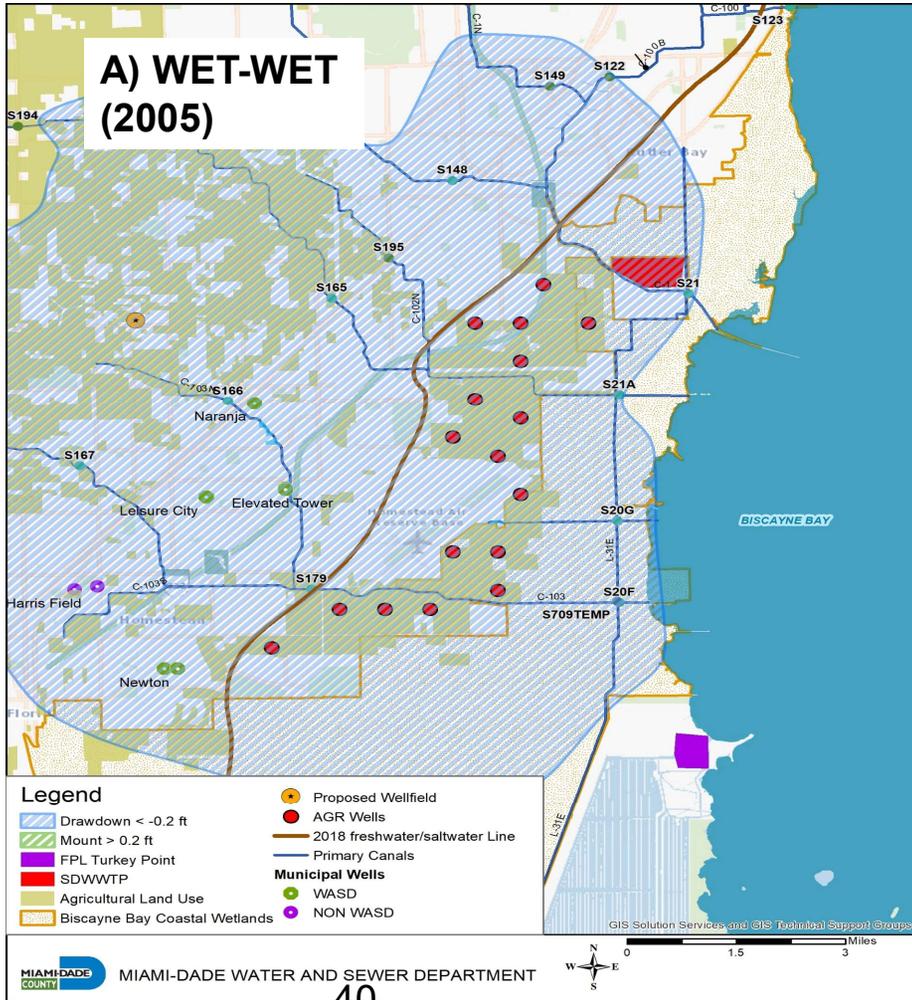
- Root zone should be between 12-18 inches, depending on the type of crop (personal communication Agricultural Manager MD-RER)
- Groundwater level should be below the root zone and leaving empty storage room for a rainfall event
- In this analysis, the optimum groundwater level should be below but closer to the bottom of the root zone under wet conditions
- Source of ground surface = Lidar 2018 (ft NAVD88); every agricultural plot is very flat



## Demo Alternative used in this Analysis

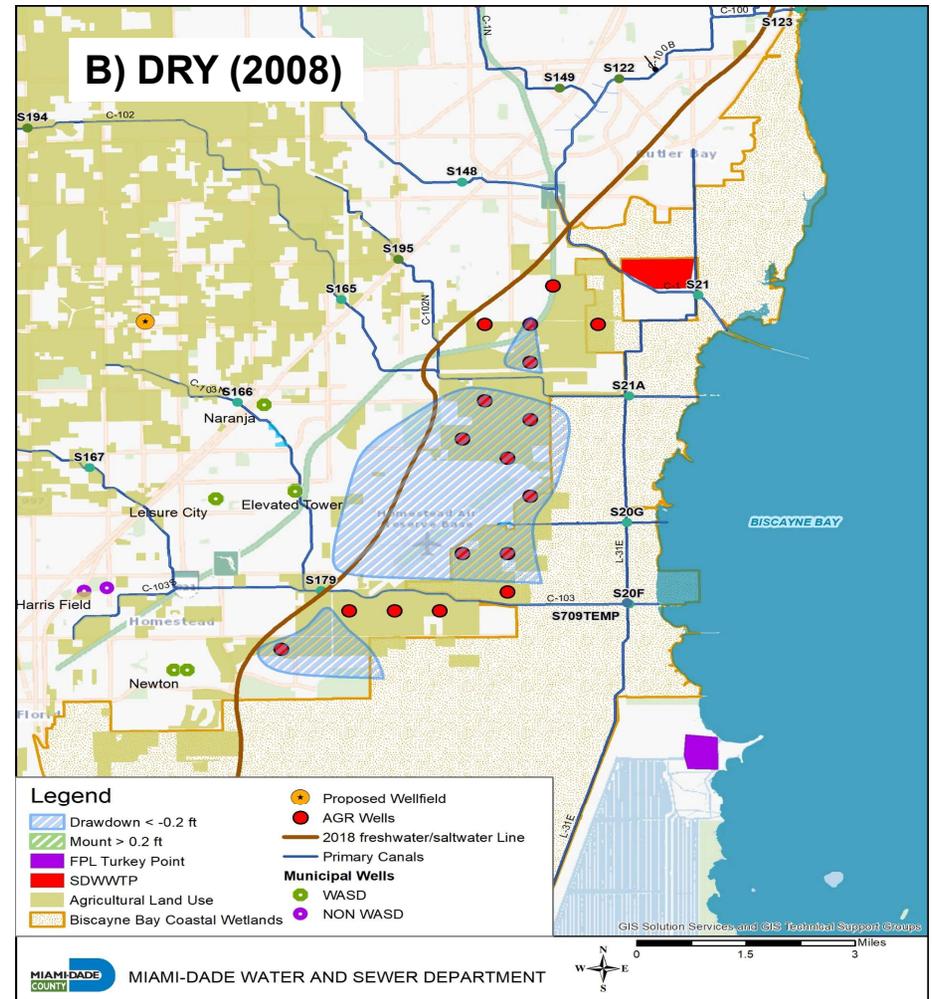
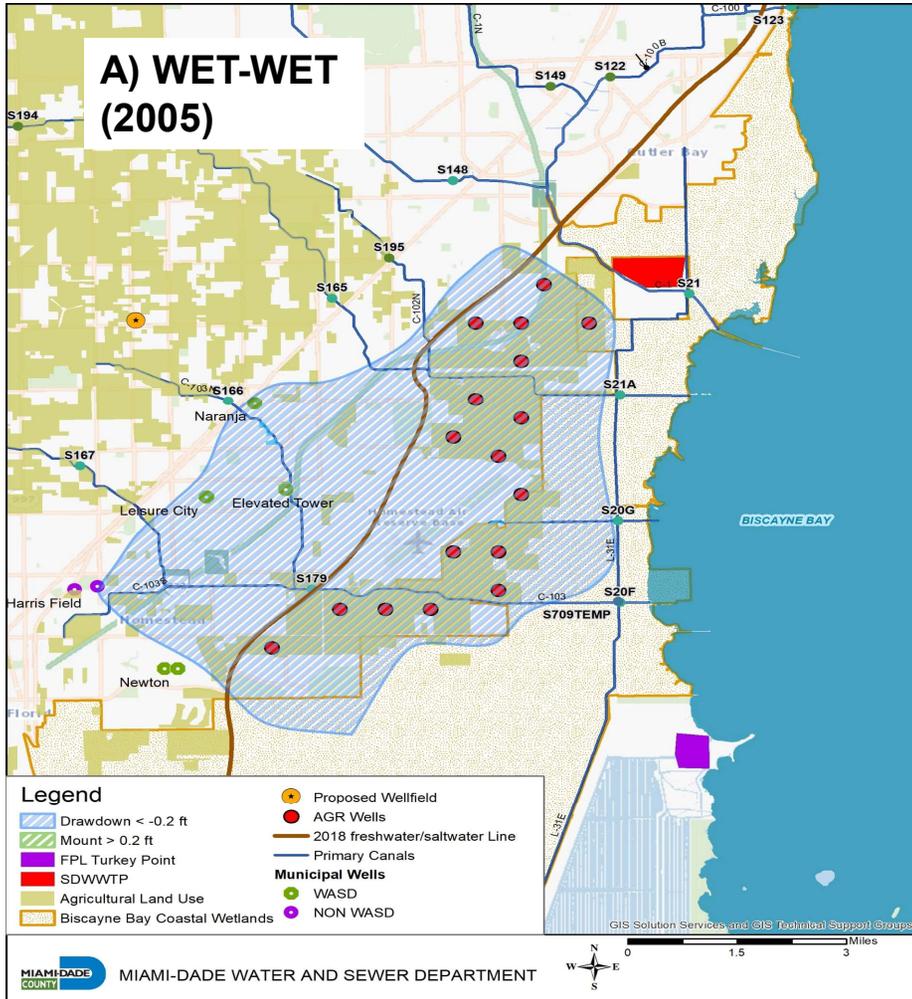
Simulation	<u>A</u> gricultural <u>S</u> easonal <u>D</u> rawdown <u>O</u> perations (ASDO)
<b>ASDO</b>	Current Condition; using model effective opening based on historical SFWMD's conditions for ASDO
<b>No Action</b>	No ASDO; reducing model opening "only" when gate is open
<b>DEMO_ALT</b>	<b>"No Action", but pumping seasonally in agricultural areas (20 and 40 MGD for dry and wet-wet respectively). A final alternative may not need continuous pumping.</b> <b>optimal number of wells TBD: low pumpage and minimal salt front issues; centralized ASR</b>

# Change on groundwater level with respect to No Action February zone of influence > 0.2 ft = (ASDO) - (No Action)



# Change on groundwater level with respect to No Action

## February zone of influence > 0.2 ft = (DEMO\_ALT) - (No Action)



# WASTEWATER REUSE

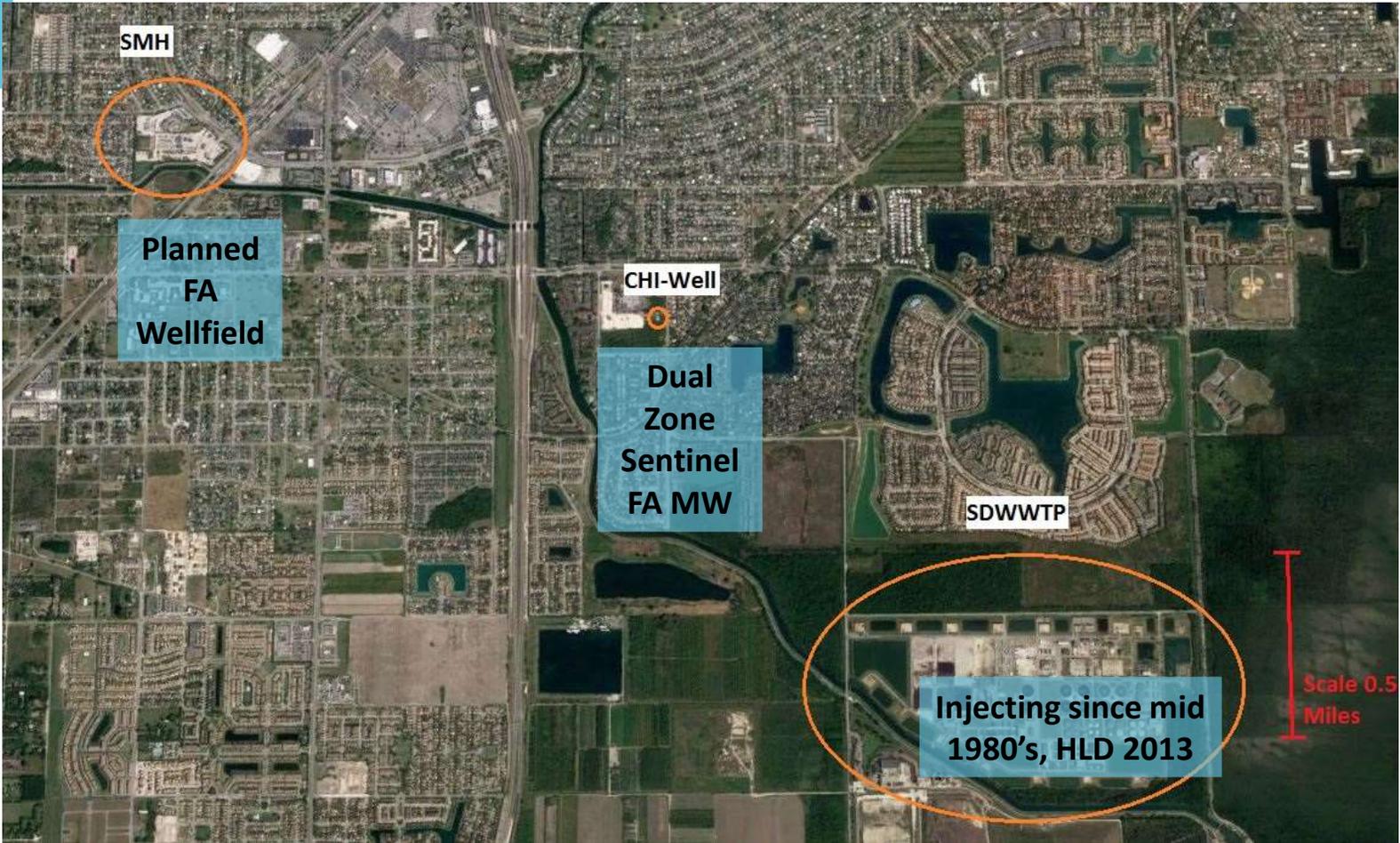
## Challenges in Miami-Dade County

- *Land application opportunities (i.e. irrigation)*
  - Economic infeasibility due to the urbanized community (as indicated by FDEP in 2015 Report to Florida Legislature).
  - Limited irrigation
- *Aquifer recharge*
  - Regulatory and economic challenges
  - Geographical position between two ecologically sensitive national parks
  - Unique connectivity between the Biscayne Aquifer and the surrounding water resources
  - Requires a significantly higher level of treatment (Outstanding Florida Waters – Antidegradation Standards, etc.)
- *WASD Aquifer Recharge Project Piloting*
  - Economic and environmental impact of aquifer recharge is much greater than that of other available water supplies

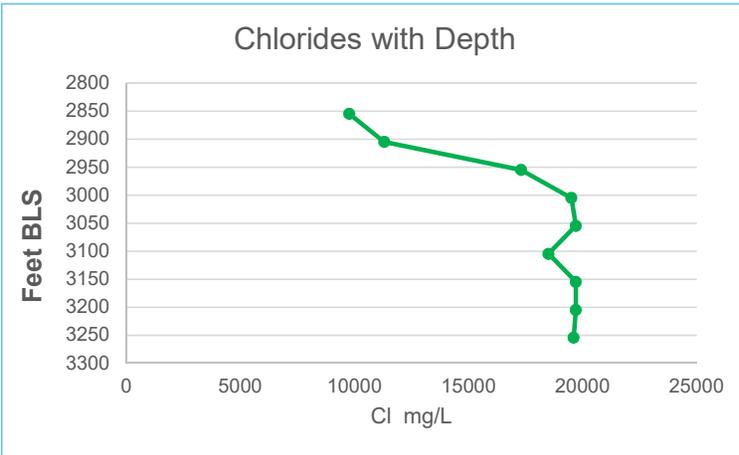
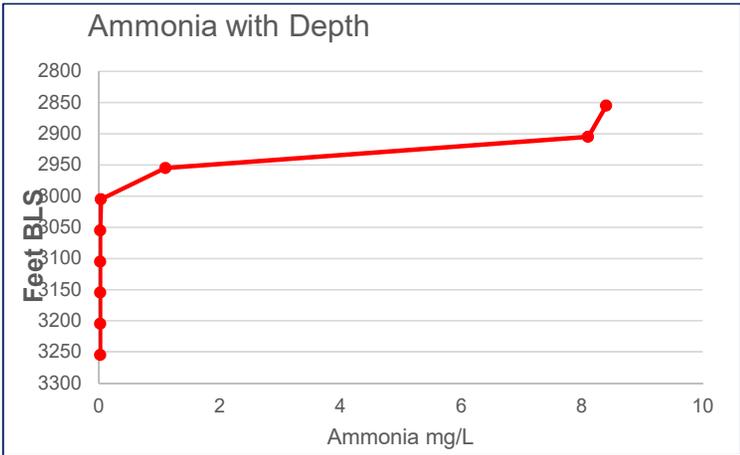
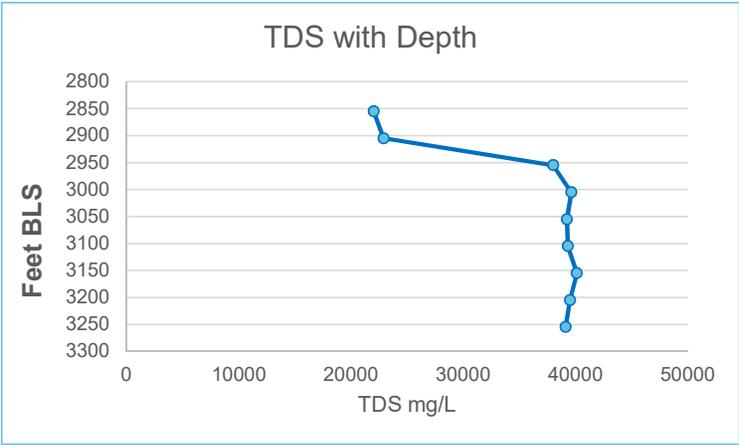




Water Treatment - Capital and Operating Costs Estimates		
Treatment Type	Capital (\$/gallon-day)	O&M (\$/1,000 gallons)
Lime Softening - Groundwater	\$2.00-\$2.50	\$0.60-\$0.80
LS + Surface Water Treatment	\$2.75-\$3.25	\$0.80-\$1.00
Membrane Softening	\$3.00-\$3.50	\$ 0.85-\$1.20
Floridan RO	\$6.00-\$8.00	\$1.75-\$2.50
Indirect Potable Reuse	\$12.00-15.00	\$2.50-\$3.00
C-51	\$5.05 - \$5.20	\$0.72 - \$0.92 <sup>A</sup>
ASR		
Wastewater Treatment- Capital and Operating Costs Estimates		
Secondary Treatment	\$1.80-\$3.20	\$0.65-\$0.80
High Level Disinfection	\$1.80-\$2.20	\$0.50-\$0.70
Deep Injection Wells & Pumping	\$0.90-\$1.10	\$0.07
Nutrient Removal (BNR)	\$9.00-\$11.00	\$2.00-\$2.50
A: includes C-51 O&M and Lime softening groundwater O&M		



Depth BLS feet	TDS mg/L	Chlorides mg/L	Ammonia mg/L
2855	22000	9760	8.4
2905	22900	11300	8.1
2955	38000	17300	1.1
3005	39600	19500	0.033
3055	39200	19700	0.02
3105	39300	18500	0.02
3155	40100	19700	0.02
3205	39500	19700	0.02
3255	39100	19600	0.02





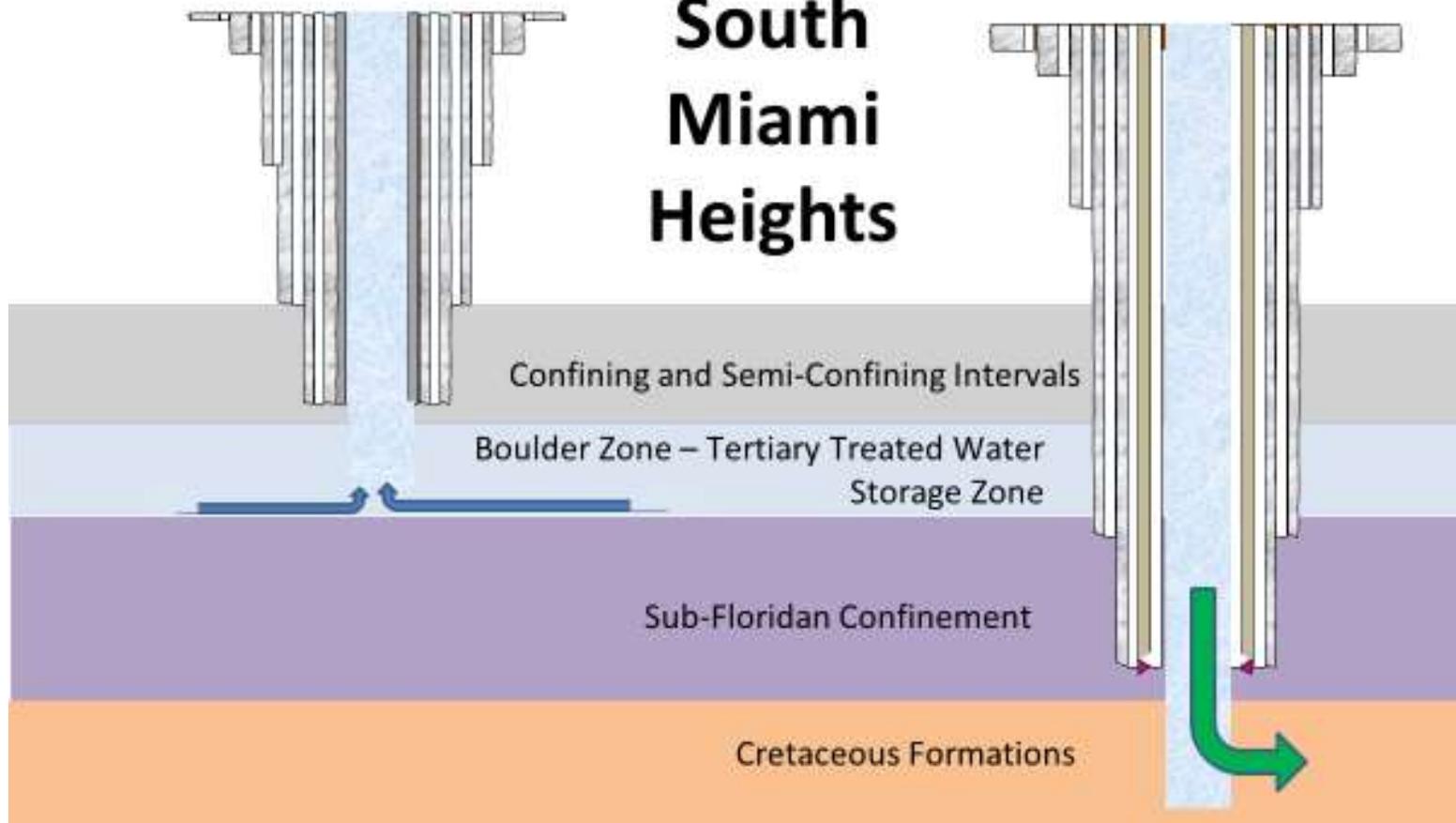
Future  
Water  
Supply?

Indirect  
Potable  
Reuse

Boulder Zone  
Indirect Potable Reuse Production well

Brine Disposal in  
Cretaceous Formations

# South Miami Heights



Cretaceous Formations



QUESTIONS

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